Notes on Pond Management *

Charles Mitchell & Don Nicholson, NCDA&CS regional agronomists

For most ponds in North Carolina, pH and alkalinity are more limiting than fertility. For this reason, the first step in pond management is soil testing and/or solution analysis. Never fertilize a pond without checking and properly adjusting its pH and alkalinity first.

LIMING

—When is it necessary? Acid soils and soft water are not conducive to fish production. To find out if liming is necessary, submit a sample of pond water for solution analysis. If the report shows total alkalinity and/or hardness values of less than 20 parts per million (ppm), liming is probably warranted. You will need to collect a soil sample to find out how much lime to apply.

—What does it do? The addition of lime to a pond increases the concentration of carbonates. Carbonates bind with the carbon dioxide produced by plants and animals living in the water. By binding with carbon dioxide, carbonates reduce the acidity of the water. They increase and buffer the pH.

Increasing the pH of water has other beneficial effects. Phosphorus, which is almost always the most limiting nutrient in freshwater ponds, becomes more available as pH increases. In addition, microbial activity improves and helps decrease the amount of organic debris at the bottom of the pond.

—How do I collect a mud sample and get a lime recommendation? To determine how much lime to apply, you will need to collect a soil sample (mud from the bottom of the pond) and submit it for analysis. Be sure to enter the correct "crop code" for fish ponds (069) on the NCDA&CS *Soil Sample Information* sheet.

Samples can be collected from a boat by using a long pole with an 8-oz can attached to the end or by taking small plugs of mud with a length of PVC pipe. Randomly collect mud from both deep and shallow areas over the entire length and width of the pond. Collect from at least six locations per acre. Thoroughly mix all the mud collected, and spread it out on a flat surface to dry. Afterwards, pulverize it and fill a soil sample box.

—What types of liming materials are available? Liquid and powdered lime are common choices for liming fish ponds. Pay attention to the acid-neutralizing value when selecting a lime product. This value represents the ability of a liming material to neutralize acid when compared with standard agricultural lime with a 90% calcium

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carbonate equivalency. Hydrated or slaked lime and calcium oxide should not be used to lime fish ponds. These products could drastically raise water pH, thereby killing fish.

—How should lime be applied? Distribute lime as evenly as possible over the entire surface of a dry or full pond. For dry ponds, apply lime with a spreader and mix it into the bottom with a disc-harrow. For small, full ponds, spread bagged lime from a boat or broadcast it from the shore.

For large ponds, bulk quantities of lime may be necessary. A boat 18-feet long by 6-feet wide can carry 1500 lb of agricultural limestone. Load the lime onto a ½-inch plywood platform placed over the bow of a large boat or between two small boats. Shovel the material or wash it off the platform using a water pump, while moving the boat slowly across the pond.

FERTILIZATION

—When is it necessary? Fertilization is not the best management practice for *every* pond. Although it can triple or quadruple fish yield, it is most beneficial for heavily fished ponds. It also requires time, money and attention to detail.

As a rule, ***fertilization will not be beneficial when*** ponds

- have excessive water flow (outflow over 30-day period exceeds volume of pond),
- have extensive areas less than 2 feet deep (conducive to rooting of vegetation) or
- are already being fed for commercial fish production
- are located in watersheds where animals are grazing
- are seldom fished.

—What does it do? Fertilization can double or triple the productivity of a pond by stimulating the growth of microscopic plants (phytoplankton) and animals (zooplankton), which comprise the base of the food chain. These organisms are food for insects and small fish feed, which, in turn, are food for larger game fish.

—When should it be done? Before beginning a fertilization program, submit a water sample for solution analysis and a pond mud sample for soil testing. If water alkalinity is below 20 ppm, there is no point in putting out fertilizer. Pond pH must be adjusted first. It is best to apply recommended lime several months before fertilization, but two weeks is an absolute minimum. In some cases, a corrective lime application is all that is necessary to maintain pond productivity.

Pond fertilization requires a series of applications. Begin early in the year when the water temperature reaches 60°F. Follow up with an additional application every two to three weeks (whenever water clarity exceeds 18 inches). The actual number of applications will vary with each pond situation. Continue fertilizing on a regular schedule until late summer or fall but no later than October.

Modifications can be useful, however. It may be possible, especially in late spring and summer, to use liquid fertilizer more efficiently and produce a more stable bloom by applying it at half the recommended rate, but twice as often as the standard fertilization schedule calls for. For example, you may choose to apply 5 lb/A at two-week intervals in summer, instead of 10 lb/A at monthly intervals.

—What fertilizer materials are appropriate? Liquid, granular and powdered fertilizers are available for pond fertilization. The fertilizer grade listed on the container consists of three numbers: % nitrogen (N), % phosphate (P_2O_5) and % potash (K_2O). In general, phosphorus is more important to fish production than either nitrogen or potassium.

—How should fertilizer be applied?

Liquid fertilizers are heavier than water. They will sink to the bottom of a pond unless they are mixed well at the time of application. They must be applied into turbulence or diluted with water. Possible methods of application for liquid fertilizers include

- dripping it into the water from the bow of a boat driven by an outboard motor so that the wake of the boat and the action of the propeller mixes the fertilizer into the water;
- pouring it directly into the turbulence caused by the outboard motor;
- pouring it into a wash tub, or similar container, at the pond's edge; diluting it with more than 10 parts of water; and sloshing the mixture onto the pond surface;
- using a small pump to dilute the fertilizer with water and then pumping the solution out onto the pond [***best method for ponds smaller than 2 acres***];
- applying it full strength with a garden sprayer by directing the spray onto the pond surface while walking around the pond [Note: With some sprayers, it is necessary to dilute the fertilizer with water so that it will pass through the nozzle.]

Granular fertilizers should not be placed in direct contact with pond mud. Mud traps the phosphorus in the fertilizer and makes it unavailable. For this reason, applying granular fertilizer from a platform is preferable to broadcasting it onto the water surface. Never broadcast fertilizer granules into deep water.

The preferred method of application for granular fertilizers involves positioning a platform one foot under water to hold granular fertilizer off the bottom. Pour fertilizer or place open bags of it on the platform where it will slowly dissolve and be distributed by water currents. A platform measuring 45 square feet is adequate for a 5- to 10-acre pond. Smaller platforms can be used in smaller ponds. More than one platform should be used in ponds larger than 15 acres.

—Remember

- If water outflow during any spring or summer month is more than the total pond volume, fertilization will be pointless. If heavy outflow occurs only during winter

and early spring, you may be able to get response to fertilizer during a drier part of the year. You can reduce excessive outflow by constructing diversion ditches, enlarging the pond and/or constructing another pond above the existing one.

- Adopt a routine fertilization schedule and stick to it. Fish do not have a consistent food source when ponds are randomly fertilized once or twice a year.

- If phytoplankton do not grow after fertilization, investigate possible problems with the lime requirement, excessive water outflow, weeds or muddy water. Growth may be difficult to initiate or re-establish after potential problems are eliminated. Temperature, clouds and other weather-related factors can be influential.

Additional Resources

Deal C, Edwards J, Pellmann N, Tuttle RW, Woodward D. 2000. Ponds—planning, design, construction (revised). Washington (DC): United States Department of Agriculture, Natural Resources Conservation Service. Agriculture Handbook 590. 85 p.
Available online: fairfaxcounty.gov/nvswcd/aghandbook.pdf

Jensen JW. 1990. Fertilizing fish ponds. Auburn (AL): Alabama Cooperative Extension System. Publication ANR-249. 4 p.
Available online: www.aces.edu/pubs/docs/A/ANR-0249/

Lazur AM, Cichra CE, Watson C. 2002. The use of lime in fish ponds (revised). Gainesville (FL): Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Fact Sheet FA38. 5 p.
Available online: edis.ifas.ufl.edu/BODY_FA028

Lewis GW. 1999. Pond fertilization & liming. Athens (GA): University of Georgia College of Agriculture and Environmental Sciences and Cooperative Extension Service. Bulletin 867. 8 p.
Available online: pubs.caes.uga.edu/caespubs/pubs/pdf/b867.pdf

Rice JA, Noble RL, Curry RL, editors. 1999. Pond management guide (revised). Raleigh (NC): N.C. Cooperative Extension Service in cooperation with N.C. Wildlife Resources Commission. Publication AG-424. 30 p.
Available online: www.ces.ncsu.edu/nreos/wild/pdf/pond/mgt_guide.pdf

Wright RA. 2001. Liming fishponds (revised). Auburn (AL): Alabama Cooperative Extension System. Publication ANR-232. 3 p.
Available online: www.aces.edu/waterquality/articles/0109001/0109001.pdf

Wynne F. 2002. The use of agricultural limestone and gypsum in ponds (revised). Mayfield (KY): Kentucky State University Cooperative Extension. 3 p.
Available online: aquanic.org/publicat/state/ky/liming_wp.htm

Sample Reports

NCDA&CS Agronomic Division **Phone: (919)733-2655** **Web Site: www.ncagr.com/agronomi/** **Report: S00613**

Grower: *Copies To:*

Solution Analysis Report

Farm:

5/25/2006

Sample Information	Laboratory Results (parts per million except for EC, pH, SAR and where otherwise noted)														
Sample ID:		*N*		*P*	*K*	*Ca*	*Mg*	*S*	*Fe*	*Mn*	*Zn*	*Cu*	*B*	*Mo*	*Cl*	*Na*
1	*Total*			0.36	3.98	11.9	1.65	3.40	5.09	0.05	0.04	0.00	0.05		8.73	5.63
	IN-N	0.84		VL	VL	VL	VL	L	H	VL	VL	VL	VL		VL	VL
Waste Code:	*-NH4*	0.20														
IO	*-NO3*	0.64	VL	*Ni*	*Cd*	*Pb*	*Al*	*Li*	*Se*	*EC*	*pH*	*SAR*	*Total Alkalinity*	*Hardness*		
Description:	*OR-N*									9	5.61	0.40	20	36		
Overhead	*Urea*	0.45								VL	L	VL	VL	L		

Recommendations:

Iron is very high in the water. This element can cause damage to the buds of tiny seedlings that are sensitive to this element. The water should not cause damage if it is applied directly to the soil. You may want to resample this water to determine if the value drops. You may want to consider aerating the pond to reduce the iron level. Otherwise, the general nutrient content of the water does not appear to indicate any concentration that might be harmful to growing plants.

Shaun Casteel, Agronomist

Sample Information	Laboratory Results (parts per million except for EC, pH, SAR and where otherwise noted)														
Sample ID:		*N*		*P*	*K*	*Ca*	*Mg*	*S*	*Fe*	*Mn*	*Zn*	*Cu*	*B*	*Mo*	*Cl*	*Na*
POND	*Total*			0.01	0.85	1.51	1.83	8.53	0.09	0.02	0.03	0.00	0.02		14.3	9.37
	IN-N	0.57														
Waste Code:	*-NH4*	0.25														
FP	*-NO3*	0.32		*Ni*	*Cd*	*Pb*	*Al*	*Li*	*Se*	*EC*	*pH*	*SAR*	*Total Alkalinity*	*Hardness*		
Description:	*OR-N*									12	3.36	1.20		11		
Fish Production/Recreation	*Urea*	0.00														

Recommendations:

Water pH and alkalinity are well below the desired range for fish production. Liming will improve both of these factors. I suggest sampling the soil along the bottom of the pond for lime recommendations. After collecting the soil, I would allow the soil to dry out then submit the sample to the NCDA Soil Testing section. Otherwise, the general nutrient content of the water does not appear to indicate any concentration that might be harmful for fish production.

Shaun Casteel, Agronomist

Sample Information	Laboratory Results (parts per million except for EC, pH, SAR and where otherwise noted)														
Sample ID:		*N*		*P*	*K*	*Ca*	*Mg*	*S*	*Fe*	*Mn*	*Zn*	*Cu*	*B*	*Mo*	*Cl*	*Na*
POND	*Total*			0.91	45.7	36.3	112	51.1	0.19	0.03	0.02	0.00	0.37		1927	983
	IN-N	1.01														
Waste Code:	*-NH4*	0.62														
AP	*-NO3*	0.39		*Ni*	*Cd*	*Pb*	*Al*	*Li*	*Se*	*EC*	*pH*	*SAR*	*Total Alkalinity*	*Hardness*		
Description:	*OR-N*									446	5.51	18.20	10	549		
Pond Water	*Urea*	0.00														

Recommendations:

Concentrations of potassium, magnesium, sulfur, chloride and sodium are beyond normal background levels of general water. The major concern is the extremely high levels of chloride and sodium. Thus, the water can not be used routinely to irrigate plants either in the field. I would locate a better water source for plant production.

Shaun Casteel, Agronomist